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OBSERVATIONS ON LEPROSY

INVOLVING

CERTAIN HYPOTHETICAL VIEWS

ON ITS

INTIMATE PATHOLOGY

AND

ON WHICH HAS BEEN GROUNDED THE SUCCESSFUL TREATMENT OF THE DISEASE

BY MEANS OF

CARBOLIC ACID

IN

UNION WITH THE VAPOUR OF WATER AT 212°

AND FURTHER SUGGESTING THE USE OF LIKE MEANS IN THE TREATMENT OF ZYMOTIC DISEASE GENERALLY IN MAN AND BEAST

PRESENTED by the AUTHOR.

BY

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OBSERVATIONS ON LEPROSY.

Of the many interesting questions comprised within the wide domain of Pathology—the more interesting from the obscurity which still conceals their intimate nature, there is not one—at least from my point of view, of such deep interest as that of Leprosy. Tried by this test—obscurity, it is surely not too much to say that the entire Nosology might be searched in vain to find a disease of whose intimate nature so little, absolutely, is known; and this, too, of a malady whose antiquity is coeval with man's earliest records. In a paper on this subject, entitled "Observations on Leprosy and its treatment by means of Carbolic Acid in union with watery vapor," and which the able conductors of "The Indian Medical Gazette" honored me by publishing in the issues of their Journal for November and December 1874 and January 1875, I remark—having regard to the labours of recent investigators, notably those of Dr. Gavin Milroy, that it seemed to me not unreasonable to hope that this malady—Leprosy, "shall not continue much longer to be the opprobrium of Medicine, but that it might yet soon pass from the obscurity in which it had been left, almost from Levitical times, into the category of disease whose intimate nature modern investigators has brought to light." That those anticipations are as far as ever from being realized will, I venture to think, be at once apparent when regard is had to the recent published labours of the several distinguished workers, notably those in the field which the Scandinavian peninsular opens to them, where this terrible disease may be studied in its every phase of development; and equally, in the voluminous and pains-taking work in which Surgeon Major Carter has embodied his labours in a like field in India. But to the Physiologist "there arises a light in the darkness;" and since, in the experimental direction in which his science has been working in recent years, he has dispelled some of the many obscurities which veil from view the conditions which govern life in health, and, concurrently, life in disease, it may be that he may yet cause Leprosy to cease to be what it assuredly now is, the opprobrium of Medicine.

In the "Observations" above referred to, I gave expression to like views in the following words—"Let regard only be had to what Claude Bernard has achieved by his labours and investigations in the field of "Experimental Physiology and Pathology," and surely such hope will not appear illusory. For, have we not seen in these our days, how, bright is the light that has been thrown by this illustrious Physiologist on diseases whose intimate nature, not so long ago was as obscure as is that of Leprosy now? With perfect truth it has been said by another distinguished French Physiologist—Milne Edwards—"*La médicine est un art dont les progrès sont en grande partie dépendant de ceux de la physiologie.*" In the following communication on this subject—Leprosy, it will be my object, as much as I possibly can, strictly, to confine myself to such an expression of my views of the disease as will serve to strengthen the hypothesis, I have formed, as to its intimate pathology, and on which I have based the treatment and its *modus operandi*, by means of "vaporized Carbolic acid in union with watery vapor." Confined within such narrow limits, vexed questions, involving differences of opinion of the varied conditions which obtain in the disease, will be avoided—an intention which, it is hoped, will serve to protect me against the imputation of self-opinionated vanity. Let me further add that, since my range of observation of this disease has been altogether confined to India, I am, necessarily ignorant of differences of character, if indeed any really exist, which different conditions—climatic and other, may have created in the disease external to my field of inquiry.

Following, therefore, the rule I have prescribed for myself in this paper, and confining my utterances, alone, to what I have seen of the disease in India, it appears to me that, in Leprosy, we confront a disease *sui generis*, isolated in, and having no relation whatever to any other in the Nosology—a disease which has clung to mankind throughout all time,—a mystery, like life itself, and its so-called laws. And unique as the disease undoubtedly is, it is no less so in its unity; for, although systematic writers have deemed it expedient to deal with it, in such wise, as almost to impart to their descriptions of the so-called varieties—Anæsthetic and Tubercular Leprosy, specific differences, it would yet be easy to show, that no such diversity really exists to justify interference with the generic unity of the disease, such diversity being more apparent than real, and easily explicable by what is known to obtain in other diseases whose course is so often modified by temperament, diathesis, or proclivities to other diseases—hereditary or acquired. And here it may be well to remark that, in studying what may be called the Natural History of Leprosy, the observer, in India, encounters many difficulties against his attaining a knowledge of its *earlier* manifestations, and its insidious approach, such as those now alluded to; and others which, under the general term—prodromata, may be held to include heredity, contagiousness, &c. Hence, no doubt, the source of much of that divergence of opinion of writers on certain vexed questions in relation with the disease, and which are as far as ever from solution. And no wonder when one reflects on the source whence, for the most part, is derived our knowledge of the disease, the inmates of our Leper Hospitals, outcast wanderers, starvelings, "steeped in poverty to the very lips," forlorn creatures who have sought in those dismal retreats a very partial relief from the outside misery and isolation to which their terrible malady has condemned them.

Long ago, in this class of Lepers, all that once belonged to the *incipient*, has merged into the fully developed disease which may now, indeed, be studied in its every phase of development. And equally futile are attempts at elucidation of those earlier manifestations of the disease, beyond the precincts of those Lazar-houses; for although Leprosy, like death, is equally impartial, and reckons its victims in every rank and condition of Hindoo society, there nevertheless attaches to it a sentiment of such repulsive horror and shame, associated with an equally deep-rooted conviction of its being utterly irremediable that, with the very first sign of the presence of the dreaded malady, the Leper, at once abandons all hope, and, henceforward, finds his only solace in seclusion from the world. From this fact it may further be gathered, that poverty and its attendant evils cannot, truly, be viewed as primary causative factors in the evolution of Leprosy. It would be to transgress the limits that have been prescribed to me here, were I to do more than attempt to convey, as succinctly as I possibly can, my views on such of the more prominent ruling conditions of Leprosy and its intimate nature which suggested to my mind the hypothesis I have ventured to advance, and to found on it the treatment of the disease by the means set forth in the "Observations" before alluded to. It may be that "Experimental Physiologists," microscopists and others, are even now on the right track, and may soon be able to adduce positive evidence in support of the hypothesis I have ventured to advance, that Leprosy has its certain source in a veritable *contagium vivum*, and that its place in the "Nosology" ought to be in the Class Zymotic, where, indeed, it would be associated with other diseases much less entitled to such a place in the existing nomenclature. With evidence so strong as scarcely to be impugned, of heredity—evidence much more conclusive than that on which a like factor rests in the evolution of Cancer, Tubercle and diseases of a kindred nature—so, too, are the proofs of its contagiousness stronger than those which, rightly affirm its existence in the latter. Of the influence of heredity, operating equally on health and disease, all are agreed—heredity one of the many insoluble mysteries of Life, unknowable, almost unthinkable! That in the minute speck of protoplasm forming the embryo, without any structure discernible under the highest microscopic power hitherto applied, should reside "the promise and potency" of all animal life both in health and disease is, surely, "past finding out." In its pathological condition heredity exerts its controlling force in many familiar directions, *e.g.*, in Cancer, Tubercle, and equally so in Leprosy; and in all those and allied maladies the curious condition—dormancy is, I believe, never absent. In his latest work, published shortly before his lamented death, Claud Bernard, speaking of this condition—dormancy, under the term "*La vie Latente*," gives examples of its influence taken, equally, from the animal and vegetable kingdoms. "*On peut dire que la vie à l'état latent est purement virtuelle; elle existe,* prête à se *manifester, si on lui fournait les conditions extérieures convenables; mais elle ne se manifeste ancunement si ces conditions font defaut.* But the term heredity has relation only with a living entity, while in the sense in which dormant, or *la vie latente* are here used, potential life is predicated, conditions which, I venture to affirm, will yet be shown to be essential factors, and, as such, never absent in the evolution of Leprosy. For, from my point of view, the primary causative agent in the evolution is *living matter*—a germ, if you will, by uninterrupted descent, away far back in the remote ages of man's earliest history, present in the original embryonic mass where it may remain "*latent*" in its embryonic condition, during, it may be, the ~~active~~ life of the individual, and only requiring favourable conditions "*les conditions extérieures convenables*" to emerge into active life and run its natural course. I have before alluded to the influences which oppose the attainment of any clear knowledge of those earlier symptoms which, for a longer or shorter time, *precede the outward manifestations* of the disease. Without question such precursory indications do actually occur, an opinion I can fully verify from evidence I had exceptional opportunities of gaining in India, and may possibly mark the moment when, as occurs in all zymotic diseases, the so-called germ has ceased to be dormant, and having passed into the circulation and finding there an appropriate *pabulum*, grows and multiplies, producing its kind and thus comporting itself as only living matter can. Such, undoubtedly, is the normal course of all truly zymotic diseases having their source in living poisonous germinal matter; only through the blood can the subjective specific phenomena of each *contagium* be manifested; and thus it is with the active living germinal matter of Leprosy, which having gained access to the fluids of the, hitherto, uninfected organism, undergoes a process of indefinite multiplication whereby the entire mass of the blood is contaminated, and the specific disease gradually evolved—slow in some cases, much more rapid in others, for temperament, diathesis, and hygienic conditions operate no less in this than in most other diseases. But whether rapid or slow in its development, there belongs to Leprosy a feature which distinguishes it from all other known diseases—a feature which, if not present from its earliest inception, is, at least, the earliest recognizable link in the chain of morbid action which is about to be forged. On this part of my subject, in the "Observations" more than once referred to, I express myself in the following words:—"that long before any of the characteristic indications of Leprosy have manifested themselves, morbid changes have been at work in the primary centres of nervation, and it is only when these have continued to operate for a longer or shorter time that at length those lesions of nutrition constituting the disease come into being; it may be that those *primary* deep-seated changes of which I speak, may long escape detection, but that they are present, when first the symptoms of the malady are observed, preceding, accompanying and controlling its every phase, is placed beyond question. Since the publication of those "Observations," any subsequent researches which have been made by several distinguished workers both in Europe and India to elucidate the *intimate* pathology of Leprosy, have only added force to the opinions I had advanced, and which were based on Claude Bernard's postulate "*that nervation is the primary power which dominates over the animal organism, and its functions both in health and disease,*" and further, that the practical teaching of this postulate irresistibly led to the conclusion, now expressed, to the effect of innervation being primarily involved long ere yet the characteristic symptoms of Leprosy have forced attention to its existence. That nervation is profoundly involved in the disease will at once be apparent, on a reference to the elaborate works on it which have been published in recent years,—notably those of Dr. Gavin Milroy, and Surgeon-Major Carter, where are given graphic descriptions and illustrations of the structural changes wrought, during the course of its fully developed and final stages. But of those earlier organic changes in nervation which, for a longer or shorter time, undoubtedly precede the invasion of the earliest characteristic marks of the malady, there is no record for, as shown before, the exceptional conditions which attach to it are such as very greatly to hinder, if not wholly to prevent, investigation on this part, at least, of the subject. But, although, somewhat wanting in this regard, it will, I think, scarcely be disputed that the following train of symptoms, which for the most part I have been able to verify, from personal observation, will carry conviction to the minds of all, that the intimate Pathology of Leprosy has its earliest recognizable starting point in nervation. Thus, previous to the appearance of any visible external symptom, and concurrently with a somewhat vaguely depressed state of health, alternating with ague-like chills and feverishness, neuralgic pains are experienced with a feeling of creeping and formication in trunk and extremities, by numbness in a hand or foot, succeeded by an intense burning sensation passing into formication, or tingling along the course of one or more of the nervous trunks. In no case that I have ever seen has hyperæsthesia been absent, and this symptom is very often associated with a vesicular eruption or even with pompholix—like bullæ.*

This hyperæsthesia is, at times, circumscribed to mere patches of the skin, or else involves extensive surfaces, as a limb or a great part of the face, and may become so intensified, that on the slightest touch the patient experiences an almost electric shock; every movement causes violent pains such as characterise *Neuralgia* in its severest forms. Such a precession of morbid phenomena, appearing, in a more or less marked degree, for a few months or even longer, in advance of the very earliest *outward* signs of the incipient disease, is, I venture to think, confirmatory evidence of the truth of the opinion I entertain, "*that the intimate Pathology of Leprosy has its earliest recognizable starting point in the innervation;* and, further, that this characteristic condition never once quits the disease, but dominates over its entire course *ab initio usque ad finem.* The concurrence of those incipient symptoms with the period when the *contagium* of Leprosy has ceased to be latent and has passed into the circulation may, I think, be taken for granted. There the living germinal matter finds its appropriate pabulum, and there it multiplies indefinitely, but not with equal rapidity, for *diathesis* and

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* Who has not seen the frequent complication of intercostal neuralgia with Herpes Zoster,—an effect so illustrative of the influence of *impaired nervation* on nutrition.

temperament are of force in this malady as in others of allied type. Thus, in the strumous and those of the lymphatic temperament, the progress of the disease will be found, at least, according to my experience, *cæteris paribus*, much more rapid than in others of more healthy proclivities; and it may be well to add here, that it is amongst the former class that the so-called Tubercular variety of the disease is most prevalent. However this may be, it is no part of my design, at least, in the present paper, to trace the course of the disease much beyond the moment when, as suggested above, it has ceased to be incipient and has, at length, been recognized by the presence of its characteristic features. It is enough to say that with the contamination of the blood, resulting from the self-multiplication and reproduction of the living *materies morbi*, the nervation which dominates over the contraction of the arterial walls, and thus regulates vascular supply, and equally, nutrition, must be profoundly affected. In this way alone, can be explained the consecutive changes which occur,—at one time, and early in the onset of the malady *hyperæsthesia*, in almost constant association with *hyperæmia*, confined to patches, of varying size, of the cutaneous surface of the trunk and extremities, those symptoms sooner or later passing away to be succeeded by *anæsthesia*,—a symptom never once absent at this stage, and, being now present, will never leave the sufferer to the very last of his existence. And thus the disease advances, *pari passu*, with the growth and multiplication of the living leprous matter whose accumulation in the mass of the blood, sooner or later leads to obstruction to the flow of the latter through the capillary vessels, and the consequent passage through their walls of the contagious matter into the neighbouring tissues, which now become so many centres of infection. It is in the so-called "Tubercular variety" of the disease, that its force seems to be most concentrated, possibly, because here morbid proclivities and abnormal conditions, as more than once suggested, may operate. Thus it might come to pass, that in those of the Lymphatic temperament, where vascular peculiarities obtain, the leprous matter, within the minute capillary vessels might attract to it fibrine, whose coagulation and accumulation within the calibre of the vessels, might lead to the formation of the so-called tubercles present in this intensified form of Leprosy. But, however this may be, it is certain that for each step the disease takes in advance, there is a corresponding lapse in the innervation, which seems gradually to lose its controlling power over nutrition. It is as ClaudeBernard says, when speaking on Morphology in his *Lecons* *sur les Phenomènes de la Vie* p. 335—"*Dans l'organisme animal c'est le system nervieux qui est le grand harmonisateur fonctionnel chez l'adulte. Lorsque cet ajustement des organes se fait de travers, par une cause quelconque, il en rêsulte la mort de l'organisme, ou des monstruosities des malformations, comme on dit ordinairment.*" And the better to illustrate Bernard's aphorism it may not be out of place, here, to instance one of the most curious—to me at least,—as it is one of the earliest, of the *outward* morphological changes which occur in Leprosy. It is peculiar to this disease, and once seen can never be forgotten, for it is stamped on the physiognomy which assumes a "Leonine" expression evidently following on the gradual withdrawal of the nervous influence controlling "*expression.*" Only very recently, when travelling in Spain, I recognised Lepers, by this feature, whom I met in the crowded Streets of Madrid, and so too in cities in Italy, a fact suggestive of the wide range which is still the habitat of Leprosy. To me it seems scarcely an exaggeration to say of Leprosy that, in its every phase, may be seen the progressive advance of a *degraded* morphology, in direct correspondence with and consecutive on the gradual withdrawal of the innervation, so essential a controlling force on physiological nutrition. And nowhere else can those successive changes be better studied than in our Leper Hospitals in India. To quote from the "Observations" before referred to, and when speaking of the structural changes, occurring in the terminal stages of the disease I remark: .... "The stage of atrophy, therefore, in which the disease has now entered corresponds with the paralysis of both the antagonistic forces of nervation. But this paralysis is, by no means, complete, it is only partial and progressive, for, were it not so, the results would be those attending gangrenous ergotism—a disease which has this in common with leprosy, if, indeed, both are not more nearly allied in causation, that the morbific agent, in both, *operates through nervation*, the difference in results being only in degree. It would be to exceed my limits were I, here, to dilate on the stages of the disease in this period of atrophy. Briefly stated, the structural degeneration which extends from the skin, at length involves the deeper structures, gradually passing into a state of unhealthy suppuration or destructive ulceration which penetrates through the investing soft tissues down to the bone. A bulla may have preceded the ulcer, which may have healed, but, at length, a time arrives when the blister reappears, no longer to heal, but to pass into ulceration of the skin and the formation of a deep eroding ulcer .... Such ulcers are, usually, confined to the extremities—the feet and hands, penetrating the deeper tissues which are destroyed till a joint is reached—a toe, finger or even the ankle joint dropping off in a manner somewhat analogous to the destruction attending day gangrene." "And thus the disease advances, mutilation following mutilation until, almost, every semblance of humanity is obliterated and only a breathing, crawling being remains, hideous but most pitiful to see." Microscopy, which has so widened the sphere of our knowledge of the Morphology of animal and vegetable structure, both in health and disease, and, only very recently, has clearly proved that two diseases of the higher animal life namely,—"*Splenic Fever and infectious pneumo-enteritis*" are generated by a true *contagium vivum* and, further, has demonstrated the actual contagious material of more than one contagious malady, has, in respect of Leprosy, been hitherto, barren of results. Nevertheless, deeply impressed as I am with the conviction of the truth of the opinion I have advanced of the dependance of Leprosy on a true *contagium vivum*, I confidently anticipate that, at no very distant date, the microscope will succeed in verifying my view, and in removing from it all that still leaves it hypothetical. Without doubt such an investigation would be attended by many practical difficulties which only the most dexterous Microscopist could hope, successfully, to grapple with. Thus it might be that the matter potential of the disease, from being absolutely structureless in its primary form, even under the very highest known microscopic power, might elude detection, comporting itself, in this regard, precisely as the living germinal matter of other contagious maladies is known to do. But, although, *ab initio*, *ultra* microscopic, the contagium of Leprosy in virtue of its vital and indefinite self-multiplication within the circulation, would, ultimately, accumulate, obstruct and, finally, obliterate many of the minute vessels thus, necessarily, causing the morphologic tissue changes which characterise the disease. Whether or not the semi-transparent granular matter which, in the more advanced and terminal stages of the malady, is found to pervade the capillaries of the diseased structures, is the actual leprous material in its fully-matured condition is yet to be proved. That it is so, in reality, the evidence, though at present, little more than negative, is still of sufficient force as, almost, to warrant such a conclusion. Thus Professor Virchow in his description of the morbid changes wrought by the disease in the larger nervous trunks, alludes to like effects in the blood-vessels contained within the *neurilemma*, also on the changes in the neurilemma itself, and in the still more important ones wrought on the *septa* within the nerve-fasciculi and interstitial substances between the nerve-fibres. These changes are said to commence close beneath the neurilemma, in which situation there will be found a *deposit of a "highly refracting* material" which can be, further, traced along the subdivisions of the fasciculi and nerve-fibres into a number of still smaller fasciculi. And it is, in the perpetuation of this series of changes, arising from the self-multiplication of the "leprous material" and its effects on the nervation distributed to the minute vessels by which blood supply and nutrition are governed, that the disease is perpetuated throughout its every phase. But, already, I have far exceeded the limits I proposed to myself when I entered on the subject of this paper, having been, insensibly, led on by the desire to support the hypothesis I have ventured to advance on the intimate nature of Leprosy, and on which I have founded the treatment of the disease by the agency of carbolic acid when presented to the cutaneous surface, and pulmonary mucous-membrane, in a minute state of subdivision, and intimate union with watery vapor at a high temperature. According to this hypothesis Leprosy has its source in a true *contagium vivum* which, in virtue of its vitality, is capable of indefinite self-multiplication within the circulating fluids leading to tissue changes, and, further, that in its every stage, will be found a complete, parallelism with the phenomena which obtain in other diseases which, admittedly have their sources in *contagious living matter.* Assuming, therefore, the validity of this Hypothesis, it is surely not impossible that a means may be brought to light by which the low vitality of the contagious germinal matter circulating in the blood may be destroyed without injuring the normal condition of that fluid or of the tissues it supports. But, only *indirectly* could such a means be brought to bear on this living infecting *materies morbi* within the vascular area, and then, only through the medium of the general cutaneous surface and pulmonary mucous membrane. And only one agent, at least as far as I am acquainted, is available for the complete realization of this object, namely, Carbolic Acid. Of its value as an internal therapeutic means opinions are very much divided, although all are apparently in complete accord in respect of its utility in Zymotic diseases—a category in which I firmly believe Leprosy should be placed. Many years before the publication of my "Observations" (*op. cit.*) I had used this acid as a *topical* application, but, although largely diluted, it had to be abandoned, owing to its having been found too irritating, when it occurred to me, as I then stated, on "reflecting on Villemin's" exhaustive experimental researches in *cutaneous absorption*, and his conclusions therefrom that, were the carbolic acid to be presented to the general cutaneous surface *in a minute state* of sub-division, *such as it would be when vaporized by heat, and in union with aqueous vapor, absorption, would inevitably follow from a surface so absorptive and thus the means would reach the infected tissues" &c.* Of the absorptive power possessed by the cutaneous and pulmonary mucous surfaces, of absorbing medicinal and toxic agents, there can, I presume, be little question. In Claude Bernard's Leçons (*op. cit.*) pages 261, 262, when speaking on the "*Anesthésie des Végétaux et des Animaux*" he says,—"*Dans l'anesthésie de l'homme et des animaux telle qu' on la pratique ordinairement, l'agent anaesthesique arrive avec l'air de la respiration au contact du poumon ou de la peau; il est absorbé, pénètre dans le sang et vient baigner tous les organes, tous les tissues et les éléments anatomiques.*" This extract is taken from Bernard's posthumous work, and is, therefore, the latest embodiment of the great Physiologist's teaching. The following is taken from my "Observations."—"Following out the idea I determined to apply it to practice in two Leper Hospitals within my circle of administrative supervision. And here let me remark *in limine*, for the information of some who may not be acquainted with the conditions which obtain in those Lazar-houses, that it is very rare, indeed to find any of the Leper inmates in whom, on admission, the disease has not made inroads, and, rarer still, to find one in its latent stage. In most, if not in all, the fully developed disease has long been established, while in others, mutilation, distortion, and deformity indicate that soon the miserable sufferer will find relief in death. Such adverse conditions, enough in themselves to place the cases beyond the pale of treatment, are, still further intensified by others of equal force; for, while all observers agree that the great majority of cases of leprous disease, in all countries occur amongst the lowest and poorest of the people—most certainly true of the inmates of those Lazeretto, by a concurrence of opinion, equally unanimous, it is affirmed that an unwholesome and insufficient diet, the frequent use of fish, or fish much salted, often tainted or semi-putrid, exposure to atmospheric vicissitudes, without sufficient clothing, residence in foul, damp dwellings—to all of those depressing conditions have these lepers been subjected long before entering those asylums. Nor, in truth, are they in much better plight, as inmates of those institutions, in respect of hygienic conditions—dietetic and other; and, in representing this in the proper quarter, many months ago, there was no exaggeration in the statement then made "that the dietary issued to the Lepers in both the Palliport Lazeretto, and Leper Hospital at Calicut is that which is denounced by Dr. Milroy and his co-adjutors, not only as being one of the chief favouring causes of the disease, but, equally so, of its perpetuation when developed; whence it clearly follows that the inmates of those institutions are now undergoing treatment for a disease of so intractable a nature *when, at the same time, they are fully exposed to the primary influences* which called it into existence."* In the presence, therefore, of such facts, all, I presume, will freely admit that a more unpromising class of subjects, in which to test the efficacy of the proposed treatment, could not possibly be found—a consideration which, for sometime, caused me to hesitate in entering on it. At length it was commenced on the 29th January, 1872, and at first, in the Palliport Lazaretto, in the Province of Cochin, and subsequently, in the Leper Hospital in Calicut, on the Malabar coast. The method of its application is as follows, and is taken from the "Observations" (*op. cit.*)—"The mechanism by means of which the treatment is conducted is rude and simple to a degree. It consists, 1st, of a common wicker-work bell-shaped cone, large enough to contain within it the adult Leper in a sitting posture. This cone is rendered impervious to the escape of vapour by means of an outer coating of some-air proof material. To prevent the escape of vapour, a sand bag as thick as the arm is made to surround the outer circumference of the cone. 2nd,—A common tea-kettle, furnished with a bent spout two or three feet long to contain the Carbolic Acid and water to be vaporized. 3rd,—An iron tripod having a space for charcoal for ignition during the treatment. 4th,—A small foot-stool on which the Leper is made to sit while within the cone. 5th,—A tube either of tin or vulcanized Indian rubber fitted with a mouth-piece to permit the Leper from time to time to inspire from without the cone. Previous to entering the cone, a tepid bath, in which two or three drachms of common washing soda have been dissolved, is taken by the Leper. The Carbolic Acid employed is "Calverts, No. 5 for disinfecting purposes." Of this acid ʒ iij to ʒ iv, diluted in ℥ x to ℥ xii of water are put into the kettle resting on the tripod and charcoal chauffer which is then made to boil briskly. This treatment must be continued every alternate day for a longer or shorter time, varying according to the chronicity and severity of the disease. *The curative* effects of this treatment are, in the great majority of cases, not long in appearing, &c. With the "Returns" now in my possession, from the Medical Officers in charge of those Leper Hospitals, and other Reports of cases from Medical Officers by whom the treatment was tried elsewhere. I leave to others to judge whether I am not fully warranted in claiming for it a curative efficacy of the very highest order. And a just judgment will be arrived at if regard only be had to the very many unfavourable conditions under which this experiment was conducted—to the class of patients subjected to it; to the wretched hygienic conditions to which they were exposed, *even while the treatment* was being conducted—conducted too with appliances of the rudest and most primitive nature. Yet, with all those opposing influences, the reports were of the most favourable nature—several cases of "*complete cure.*" Medical Officers speak of it as "*highly curative*" "*that in the majority of cases it improves the general and physical state of the Leper.*" "*That it relieves the pricking sensation which is almost invariably associated with the so-called "Lepra Anæsthesia," whilst its influence over the so-called "Tubercular form" is most marked and energetic, the nodules dispersing and leaving the skin of its normal appearance.* The anæsthesia, as might be expected, is the last to yield, although sooner or later it does so.

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* On first assuming charge of the Administrative Medical Circle in which were those two ~~Leprous~~ Hospitals, the allowance made by Government to each Leper was 1½ annas *per diem*, equivalent to 2¼d. English money, and on this dole he had to provide himself with food—some coarse rice, and salt, semi-putrid fish. Subsequently, and after much trouble I succeeded in obtaining for the Lepers an additional half anna, bringing up the allowance to 3d. of our money.

But I claim for this treatment a far wider range of application, and would now seek to see it extended to diseases of whose intimate pathology there can no longer be any question. Doubt, necessarily, belongs to all hypothesis; and that which I have ventured to advance with respect to leprosy, is, in no degree, exempt from this inherent weakness. Still, if regard be had to the successful results, above recorded, following the use, by a novel mode of applying it, of the most powerful *anti-zymotic* means now known, there will, I think, be less hesitation in admitting the zymotic nature of the malady and according to it a place in this classification. Let this be as it may, I venture, however, to assert that little of the hypothetical, in respect of their intimate pathology, can properly be imputed to many of the diseases—human, as well as brute, which are included in the zymotic category, whose source, in actual living *contagia*, has long ceased to be mere surmise, and now rests on the basis of sure-demonstration—multiform contagia which, in virtue of their vitality are indefinitely self-multiplying within the circulating fluids and animal tissues, whilst, each endowed with an individuality (unless the phrase is misapplied) specifically its own, can only perpetuate the specific phenomena which distinguish it. For, although histologists have, as yet, succeeded in determining positively, only a few of those self-multiplying contagia of infectious disease, as Pasteur long ago did with respect to the *pébrine* of the silk-worm plague, and as Dr. Klein has only very recently succeeded in proving that the infectious pneumo-enteritis or typhoid fever of the pig is, like splenic fever, due to a "*Bacillus;*" still the fact remains, scarcely weakened by the absence of more positive demonstrative proof, that the *materies morbi* of some of the most destructive diseases falling on man and beast can be shown to reside in matter which comports itself as only living matter can—matter so minute as to be ultra-microscopic, and often so pellucid and structureless as scarcely to be distinguishable from the fluid in which it is suspended. Illustrative of this Dr. Beale, who by his indefatiguable physiological labours, and especially in this direction, has thrown so much light on the intimate sources of disease, has further clearly proved, in his exhaustive "Report to the Cattle Plague Commission," that the true source of the disease centres in multitudes of minute structureless transparent particles, and which he found, universally present in the fluids and tissues of the infected animals—demonstrative evidence of the truth of this statement having been subsequently supplied by M. F. Chauveau when he proved that in the subsidence of these particles, while the super-natant albuminous fluid was found innocuous, the full virulent effects followed on innoculation with the deposit. But this is not all, for evidence almost conclusive has been adduced by the former distinguished experimental physiologist in support of the view, that there exists besides many non-identical contagious germs, the potential agents in the evolution of diseases—contagious fevers, and many other maladies not necessarily confined to the class zymotic, and which fall with such disastrous force on man and beast; that this contagious matter, introduced from without, is, in virtue of its vitality, capable of growing and multiplying indefinitely in the vascular system; that its particles, often so minute as to be ultra-microscopic, in respect of its being apparently structureless, readily passes through the walls of the capillaries and thus invades the animal tissues, and finally, that the virulence of this living poison is due, entirely to

those particles and not to the fluid in which they are held in suspension. With this all but positive evidence now in our possession, of the nature of contagia, and of their *modus operandi* on the living organism—human and brute, it would surely be difficult to exaggerate the value of a means which, although failing to overcome, might, at least, tend to lessen the force of the calamities inflicted on animal life by those elements of evil. In writing on this subject Dr. Beale says, "It is from researches in this direction that we may hope to gain knowledge which may lead to the discovery of means of destroying the contagious germinal matter while in the blood, and of preventing the influence of poisons of another kind upon the living bioplasm of the blood, capillary vessels, and of that of the tissues immediately adjacent." But how to destroy the living contagium without involving its *living* habitat in a like destruction? Similarly, the same distinguished authority—Dr. Beale, thus speaks—"Unfortunately we are not yet acquainted with any means by which the contagious germs, which may be circulating in the blood, can be certainly destroyed, and the injury which necessarily results from their growth and accumulation in various parts of the system prevented? *but yet the facts of the case justify the hope that so desirable an end may some day be attainable. The varying action of the same condition upon different forms of bioplasm almost suggests the possibility that some agents which may destroy the contagious bioplasts circulating in the blood without injuring the normal bioplasm of that fluid or that of the tissues may be discovered. The introduction into the blood of some gas or vapour by the respiratory surface may be the means by which the desired end will be effected.*" And again, he says "*The living matter, or bioplasm, of which contagious disease germs consist, is unprotected by any external envelope or cell-wall, and would, therefore, be acted upon much more readily than the bioplasm of the tissues. In nutrition, the higher bioplasm, taking part in the tissue formation, may be nourished while a lower form, situated closely, may be starved, and even die and disappear. Regarded from this point of view, the discovery of a plan of treatment which shall insure the destruction of such forms of bioplasm as tubercle and cancer appears possible.*
The italics in those extracts from Dr. Beale's writings on this subject are mine, for they embody in very felicitous terms the design I have in view in this paper, that, namely, of calling attention to a means which, speaking from a deep conviction, I firmly believe will be found to realize much if not all of his anticipations. For are not all the desiderata formulated by him, precisely those which are united closely with the conditions that are possessed, in

the very highest degree by Carbolic Acid? but then only I venture to assert, when this agent is had recourse to by the method described at page 14 *et passim* of this paper, where will be found recorded the results following the treatment of Leprosy by this means. But only when employed in this way did the agent yield curative results; by any other mode of employing it the effects were either *nil* or else were positively injurious. How, in truth, could it be otherwise? For Carbolic Acid even when very largely diluted, is extremely irritating to the surface, while there is evidence to prove that when injected into the blood-vessels of a living animal, instant arrest of the circulation and death inevitably follow. Only, therefore, by calling into action the *absorptive* function of the skin and pulmonary mucous membrane, can Carbolic Acid be of avail as a curative agent in the diseases included within this category,—a category wide indeed, but not beyond the means proposed, and which, I consider, so full of future promise, for, in truth, it is the means which Dr. Beale desiderates, since it unites in itself every condition necessary for the realization of his suggestion,—"*a means of destroying the contagious germinal matter while in the blood, and of preventing the influence of poisons of another kind upon the living bioplasm of the blood, capillary vessels, and of that of the tissues immediately adjacent, by the introduction into the blood of some gas or vapor by the respiratory surface*" &c. Thus it is a highly volatile agent—a quality augmented a thousand-fold by its union with aqueous vapor at a high temperature. Again, in this state of minute sub-division—molecular almost, when it seems to have lost much of its irritating properties, it can be freely inhaled, while at the same time, it is presented to the cutaneous surface in such a form as to admit of its speedy and easy absorption and passage into the blood and animal tissues, to expend its force on the destruction of that low form of vitality in which contagia "live and move, and have their being."

And now to say a few words on the appliances this *modus operandi* on disease will require. From what has been advanced in the foregoing pages, it will be seen that I consider this system of treatment applicable to many and diverse diseases wide apart from each other in the Nosology. Hence, it is obvious that diversity of conditions, which must obtain in so extensive a category of disease, will necessarily demand such modification in the application of the means as shall meet the requirements of each case. It will be seen that two channels of introducing the agent into the system are present—the pulmonary mucous membrane, and general cutaneous surface, to either of which, or both simultaneously, recourse may be had. It must here be borne in mind that this plan of treatment, which on theoretical grounds, I consider so full of future promise, has never yet been put in practice, and it would, therefore, be most unreasonable and rash to a degree, were I, in the absence of data (more than are supplied by the results of its successful application to the treatment of Leprosy,) to attempt to indicate rules of procedure to be followed in its application to diseases so varied, and which, through their lapse, might bring discredit on an experiment which I consider it very desirable should be tried without delay. Still, let me say, that on theoretical grounds, I should certainly anticipate the most favourable results from recourse to the treatment, through both media—lungs and general cutaneous surface, to the entire class of diseases which, under the designation "Constitutional" includes, according to Dr. Felix von Niemeyer's classification, most of all of the "Acute Infectious diseases"—Rubeolæ, Scarlatina, Variola, Typhus Fever, Diphtheria, Malarial Fever, Cholera Asiatica, Trichinosia. And also to such diseases which this pathologist includes under the class "Chronic Infectious diseases," as Syphilis, Glanders, and also to Rabies, whose place in the existing Nosology still remains unsettled. But further, there will be found many other maladies, not included in the above classification, in which I would, on like grounds, look for very favourable results from recourse to this form of treatment, either in its entirety or in part. Thus, such maladies whose dependance on disease-producing living germinal matter, has been well established, and in which the contagious character is more or less marked, such as Tubercle, Cancer, and disease of a cognate nature, would come within this category. And again, in many of the class of cutaneous diseases, especially those of a parasitic nature, failure would, I venture to think, scarcely be possible, since in the presence of the agent, not only parasitic but all other forms of minute life perish. Before saying a few words on the appliances, which by this method of treating disease by Carbolic Acid, would be necessary; it may be well to recall to mind the fact that this agent differs materially, from others which act as so-called oxidizing disinfectants, such as Hydrochloric Acid, Sulphurous Acid, Chlorine, &c. As deodorizers, such chemical agents leave nothing to be desired, but they lack that volatility and subtle quality of diffusion—penetrability, which alone belongs to Carbolic Acid when used by the method I advocate, to entitle them to the character of efficient disinfectants. Then again, some, if not all, of those chemical agents are objectionable from their acting injuriously on the lungs, and household effects—objections which in no way apply to the vapor of Carbolic Acid. The appliances which would be required in this method of using Carbolic Acid in the treatment of disease, are simple enough, and would consist of a loose wrapper made of air-proof sheeting, sufficiently capacious to admit of the patient (while in a sitting posture) being wrapped in its folds, and, further, so constructed as to meet at his neck, but not so loosely as to permit the escape of the vapour. An air-proof elastic tube, fitted with a mouth-piece and communicating by its other extremity, with the inner surface of the vapor-containing receptacle in which the patient sits, will admit of his inhaling the vapor from time to time, should it be thought expedient to call into action both the skin and pulmonary mucous membrane in the treatment of the case. A spirit lamp, with a wick—surface large enough to supply such an expanse of flame as will keep in brisk ebullition the water to be charged with the Carbolic Acid. A metallic vessel of a capacity sufficient to contain one or two quarts of water and so adapted as to rest upon the spirit lamp. This vessel should be fitted with a spout, about eighteen inches long, to fit on an elastic tube which is made to communicate with the receptacle, and by means of which the carbolized aqueous vapor can be conveyed into it. The acid from ℥ i. ʒ i. to ℥ ii. should, I think, be "Calvert's" No. 2, or perhaps, a commoner quality might be found equally efficient, though, perhaps, not so agreeable to the patients and attendants.

A very convenient apparatus has, I believe, been patented, and is sold by Messrs. J. Allen and Sons, 64 Marylebone Lane, Oxford Street, London, which would, with some slight modifications, answer its purpose admirably. I may add that, in cases in which a milder mode of using this method might be considered advisable, the mere disengagement of the vapor from a common tea-kettle would admit of the attainment of this object. It is surprising how soon both the patient and the attendant become accustomed to the smell and other qualities of the acid.

Although I have, long ago, far exceeded the limits I had at first assigned to myself in this paper, more yet remains to be said on its subject of, as I think, much practical interest. Hitherto the subject of contagion has been dealt with from a therapeutic standpoint, but now I would seek to offer a few brief remarks on the many possible advantages which might be gained by extending the use of Carbolic Acid by the method now described to the *destruction* of the living germinal matter of disease before it has entered and after it has left the animal organism. Enough is already known of the intimate nature and origin of the different contagia, to offer a ready explanation of the mode of propagation and calling into being, each, its separate specific form of disease: Only to instance one or two of the more prominent conditions attaching to those living contagia: thus, so minute and apparently structureless are some of them, that, *e.g.*, of the Pleuro-pneumonia of the Cattle plague, in which the contagious germinal matter, as has been clearly shown by Dr. Beale, in less than $\frac{1}{100000}$th part of an inch in diameter—a quantity which equally belongs to the *materies morbi* of other and allied contagious diseases. Such minute "particulate" living matter must, in truth, be all but imponderable, and, as shown by Dr. Beale, "may readily be transferred from the affected organism to an apparently sound organism. It may be carried a considerable distance without losing its marvellous power of causing in the organism invaded, a series of changes resembling, and even in very minute particulars, the phenomena which have occurred in the organism from which it was derived." Again, so retentive of vitality are many of those contagia that, as is well known, not only may they be transferred long distances by the air, but they cling to the clothes, furniture, and walls of houses where the sick have been, for, as in the case of scarlatina, an indefinite time so that weeks and months may elapse before the death of all the disease carrying germs has taken place. Further, and *pari passu* with the demonstrated power of self-multiplication and reproduction within the infected animal organism, is the passage to the outer air of the contagious living germinal matter—elimination some call it,—pestiferous emanations from the breath, and, doubtless too, from the cutaneous surface. And so subtle too is this evil agent, especially in some of the contagious fevers occurring in man and beast, that, according to Dr. Sanderson, a very high authority on such subjects,—"the contagium of cattle-plague possesses this quality to so high a degree that in it, as well as many other contagious diseases, the breath of the diseased organism contains numbers of the potent particles of poison, and in this manner, the very air of a considerable space, or even district may become infected." Once more to let Dr. Beale speak on this subject—"It has been already shown that contagious disease-germs are so minute that they may be supported by the air and carried long distances, suspended in it in a living state. The breath of the sick is, there is reason to believe, in many cases loaded with contagious germs, and there is little doubt that the cutaneous exhalation contains them. It is, therefore, of the utmost importance that means should be taken to destroy these particles before they can leave the neighbourhood of the sick person in the sick room, *and for this purpose some easily obtainable volatile vapour must be employed.*" I have placed in italics the concluding sentence of this extract, the better to emphasize my conviction that, in Carbolic Acid, when had recourse to by the method which it has been my chief object to call attention to in this paper, will be found the full complement of Dr. Beale's desideratum—" *a volatile and liquid disinfectant which will, after first acting on the excreta, the floors, walls, &c. by its gaseous infusion, rise into the air, enter the lungs of the animals, pervade the whole building, and attack the hidden germs of infection which otherwise would escape*—all this to be done without the least possible inconvenience to the cattle and their keepers." And all those objects, I feel confident, are capable of being fully realized by Carbolic Acid, *but only when applied by the method I advocate:* for, although this agent is volatile, it is, nevertheless, when used in its free and uncombined state, wanting in that *degree* of volatility essential for the full attainment of its antiseptic properties—*diffusion over an area wide enough to control and destroy* " *the hidden germs of infection.*" Heat, no doubt, might be used to render the agent more volatile and diffusible, but, seeing that its boiling point is 370°, and, further, that under a somewhat higher temperature, it decomposes, little I apprehend, would be gained by this means. But all difficulties at once disappear when Carbolic Acid is used in union with watery-vapor at a high temperature. For, thus united, its volitality, as before insisted on, is augumented a thousand fold, and being in a state of infinitesimal subdivision—molecular one might almost say, and approximating in diffusibility to gaseous matter, it cannot fail to reach and destroy the vitality of " the hidden germs of infection over a wide extended area. Enough but surely not more than its importance demands has been said on this subject. To others will belong the duty of bringing to bear on it the test of experiment—an experiment as I believe full of promise of success and, therefore of good. Even the partial success of the means, when thus employed in the treatment of disease, would be of inestimable advantage, but when had recourse to *as one of prevention*, it would be difficult to over-rate its value. And on this last subject,—one of paramount importance if only in an economic point of view, it is a duty incumbent on me to offer a few remarks before concluding this paper. In recent years one of the very worst of the many calamities which have afflicted the human race, has resulted from the contagious diseases of varying character and virulence which have fallen with such terrible force on horned cattle. There is no room here for indulgence in platitudes, nor indeed are they needed to enforce a self-evident truth that an evil of such magnitude to all the world, as are those cattle plagues, is one immeasurably greater to the people of those islands who have to depend so much and so largely for their meat supplies from ultra-insular regions. For deriving our supplies of horned cattle from so many different sources, each one of those is, from time to time closed against us ; and there is no apparent reason to advance against the possibility of such a time in the future when, in the exercise of a prudent vigilance, Government should not be compelled to shut off every channel of supply of cattle from abroad. Even while I write, one of our most prolific sources of supply—the United States, has been cut off owing to the occurrence of pleuro-pneumonia in some recent arrivals of cattle from that country. But enough has now been said on this part of the subject, let me employ the brief space left to me, to enforce on public attention as emphatically as I can, my conviction that the employment of Carbolic Acid, by the method it has been my chief object to bring to notice in these observations, on board the ships conveying the cattle to these shores would, I firmly believe, not only wholly prevent out-breaks of contagious diseases in the cattle, during the voyage, but would (and there is evidence to confirm this view) positively cure the disease in an infected animal, should one have been unfortunately brought on board-ship, with the disease in its incubative stage. For this purpose, and from the moment the cattle are brought on board-ship, *the atmosphere* of the hold in which they are to make the voyage here, should be impregnated with the carbolized aqueous vapor, and nothing could be easier than to effect this object. No elaborate apparatus would be needed—nothing in truth more than a vessel large enough to contain the mixed fluids —Carbolic Acid and water, and the source of heat supply would be easily forth-coming in these large steam-ships which convey cattle. For obvious reasons the tube or leather hose proceeding from the charged vessel to contain the vapour, should be made to enter the hold at its "forward" part, and further, should be supplied with a stop-cock to admit of an *intermittent* supply of the vapor should, at any time, the atmosphere become surcharged with it. Let me add that economy and efficiency will be equally secured by employing the very commonest description of Carbolic Acid, or else Cresylic Acid, which is said by some to be even a more powerful disinfectant than the former. It is scarcely necessary to say that this method of using this powerful disinfecting means, would be equally available in all cases of cattle-plague and other allied contagious diseases which, from time to time, occur sporadically amongst our flocks and herds in these islands.

And so too, I desire to add in conclusion, all that has been advanced in this paper relative to the method of use of Carbolic Acid in the treatment of disease, and in its prevention, is *à fortiori*, equally applicable to the thorough disinfection of houses in which infectious diseases have occurred. I may speak on this matter with some degree of authority, having myself subjected the method to a somewhat crucial test in respect of scarlatina of a highly malignant type with the most successful results. Hence I would venture to suggest the application to the disinfection of "plague-stricken" houses as means which may be found equally powerful though less heroic than that of consuming them with fire, which, if report speaks correctly, is the method recently put in practice in countries where the pest now prevails.

Harlech, Westcliff, Bournemouth,
March 14th, 1879.

Addenda

lic Acid vapor evolved in [illegible]
of water at 212°F. would suffice in the
of disease in man, but vapor of much
tension evolved at a much higher tem
would be required to fulfil the objects
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oppose — "by its diffusion oxygen an
enough to control & destroy the hidden ger
ction" Hence an apparatus specially ad
; object would be required

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